REMARKS

Claims 1-20 are pending in this application. Claims 3-6, 8, and 19 are merely objected to as being dependent upon a rejected base claim, but otherwise stand allowable over the prior art of record. Claim 14 has been amended. Claims 1, 2, 7, 9-18, and 20 stand finally rejected, and are at issue herein.

The Examiner has rejected claims 1, 2, 7, 9-18, and 20 under 35 USC §102(b) as being anticipated by Erickson et al. (U.S. Patent No. 6,394,135). Specifically, the Examiner has cited to figures 5 and 9 of the Erickson et al. '135 patent. The applicants have thoroughly considered this ground of rejection and the reference cited by the Examiner against the claims of this application, but must respectfully traverse this ground of rejection. Reconsideration of this ground of rejection in view of the following remarks and indication of the allowability of claims 1, 2, 7, 9-18, and 20 at an early date are respectfully solicited.

The Examiner has correctly pointed out that the title of the Erickson et al. '135 patent is "Balanced Plug Valve With Contour Wall" (emphasis added). However, while the Examiner has indicated that the construction of the Erickson et al. '135 balanced plug valve is "identical to the instant device", the applicants respectfully submit that a significant difference between the construction of the instant invention and that of Erickson '135 exists. The applicants respectfully submit that this difference patentably defines over the Erickson et al. '135 structure.

The applicants wish to draw the Examiner's attention to the fact that the assignee of the instant application is also the assignee of the Erickson et al. '135 patent, and that the inventors are thoroughly versed with the Erickson et al. '135 balanced plug valve. Indeed, the applicants have described the Erickson et al. '135 balanced plug valve in the originally filed specification in paragraphs [0009] and [0010]. These two paragraphs are reproduced below for the Examiner's convenience.

> **[0009]** In view of the foregoing limitations and shortcomings of the above noted devices, as well as other disadvantages not specifically mentioned, a balanced plug valve with the ability to predictably modulate flow and also provide for tight shut-off of flow was developed by the assignee of the instant invention. This a balanced plug valve with a contour shaped wall is described and illustrated in U.S. Patent No. 6,394,135, issued on May 28, 2002, the teachings and disclosure of which are incorporated herein in their entireties by reference thereto. The contour

shaped wall of this balanced plug valve forms a gap with an edge of a balanced plug. Fluid is able to flow through an input port, through the balanced plug, through the gap, and out an output port. The shape of the contour and the relative position of the balanced plug to the contour shaped wall affect the modulation of the rate of the fluid flow through the gap, and thus, through the valve. Multiple possible variations of the dimensions of the contour shaped wall make possible a multitude of flow rate verses valve stroke relationships. Further, the use of a balanced valve decreases friction forces on the plug which allows for smaller, more efficient, and more economical valve actuators.

[0010] While this balanced plug valve presents significant advantages to the art and provides fully balanced operation on a two-way valve with an external contour, operation with an internal contour, such as shown in FIG. 6 of the Erickson et al. '135 patent, is not quite balanced. That is, when the valve is closed, fluid pressure acts on one end of the plug, while the internal edge of the plug that sealing engages the contoured edge is isolated from this fluid pressure. As a result, there is a pressure differential across the plug, resulting in unbalanced forces. (emphasis added).

As pointed out by the applicants in the originally filed specification, the structure of Erickson et al. '135 results in an unbalanced condition when the valve is in the closed position because the fluid pressure acts on one end of the plug while the internal edge of the plug that sealingly engages the contour edge is isolated from the fluid pressure. As a result, there is a pressure differential across the plug that results in the unbalanced forces.

Turning to the illustration of FIG. 5 of Erickson et al. '135 cited by the Examiner, it can be seen that the lower edge and the upper edge of the plug 24 are both contoured. As shown in FIG. 5 in dashed lines, when the plug 24 sealingly engages the uppermost seal (44) there is no gap that allows the fluid pressure to act on this end of the plug 24 to balance the pressure that acts on the bottom most end of this plug. That is, when the plug 24 is in the closed position, fluid pressure is able to act only on one end of the plug (the lower end as shown in FIG. 5). The upper end is isolated from the fluid pressure when the plug is in sealing engagement with the uppermost seal (44). This is because the pressure of the fluid entering from the right hand side of the illustration of FIG. 5 can act on the lowermost end of the plug and fills the interior chamber within the plug. However, since the inner wall of plug 24 is flat, and since the upper edge of plug 24 mates with the top of bonnet 14, there is no way for the fluid pressure to act on the uppermost end of plug 24 to balance the pressure that is acting on the bottom most end of plug 24.

This same result occurs in the three-way valve illustrated in FIG. 9, also cited by the Examiner, when the plug 24 is positioned in its uppermost or lowermost sealing position. Certainly, while the plug 24 is in an open position as shown in FIG. 5 in solid line and in FIG. 9 in solid line, the fluid pressure acting on the topmost and bottommost edge of plug 24 results in balanced operation of the plug, and provides a significant advantage over the previous valves. As unbalance occurs, however, when the plug is closed.

Unlike the balanced plug valve of Erickson et al. '135, the balanced plug valve of independent claim 1 requires that the balanced plug include, *inter alia*, a sealing end configured to expose a pressure balancing surface to the fluid pressure from the inlet when in sealing engagement with the valve seat. While this pressure balancing surface may be seen in a number of the figures of the instant application, it may best be seen in the exploded illustrations of FIGs. 13 and 14.

As illustrated in FIG. 13, the balanced plug valve is shown in an open position. In this open position the fluid pressure P_2 acts on both the upper 74 and lower 80 edges of the plug 28. This is a similar situation to that illustrated in Erickson et al. '135. However, unlike the construction of the balanced plug valve of Erickson et al. '135, the plug is configured to expose the lower edge 80 of the plug 28 to the same fluid pressure that acts on the upper edge 74 when the plug is in sealing engagement with the valve seat. This may be seen in the illustration of FIG. 14, and is described in the originally filed specification in paragraph [0049]. This paragraph is reproduced below for the Examiner's convenience.

> **[0049]** When the flow of fluid through the valve is desired to be stopped, the plug 28 is positioned such that sealing point 78 comes in sealing engagement with O-ring seal 48. In this way, no fluid is able to flow through flow gap 100 to the valve outlet. However, it is important to note that surface 180 is still exposed to the fluid pressure P_2 of the fluid source while the valve is in this closed position. In this way, the plug 28 is still balanced, and will not require any additional power from the actuator to overcome a fluid imbalance that exists with prior valves. That is, because the fluid pressure P_2 is still able to act on surface 80 of plug 28, this fluid pressure balances the fluid pressure that continuously acts on surface 74. Without such a gap, the fluid pressure P_2 acting on surface 74 would tend to hold the valve in its closed position, and would require additional force to be applied from the actuator to overcome the fluid pressure differential across the plug 28. In prior valves, this often resulted in an overshoot once the valve was opened and the fluid pressure was

> again balanced across the plug. Such an overshoot made precise flow control difficult. However, such pressure imbalance while in the closed position is eliminated with the design of the present invention.

As may be seen from an examination of this FIG. 14 and the associated description, while in a sealing engagement with the valve seat the plug remains fully balanced because the fluid pressure from the inlet that exerts a force on the first end also exerts that same force on the pressure balancing surface when the plug is in sealing engagement with the valve seat. This differs significantly from the construction of the balanced plug valve of Erickson et al. '135 which does not include a pressure balancing surface that is exposed to the same pressure as the other end of the plug when the plug is in sealing engagement with the valve seat. As such, Erickson et al. '135 cannot anticipate independent claim 1.

In view of the above, the applicants respectfully submit that independent claim 1 is in condition for allowance. Reconsideration of this ground of rejection and indication of the allowability of independent claim 1 and those claims dependent thereon, to wit claims 2-13 at an early date are respectfully solicited.

Independent claim 14, as amended, requires, *inter alia*, that each of the first end and the second end be configured to expose a surface thereof to fluid pressure from this same one of the at least one inlet and the outlet when one of the first end and the second end is in sealing engagement with the at least one valve seat. This is provided such that the fluid pressure on the perimeter wall in a direction tending to impede linear movement of the balanced plug is balanced by fluid pressure on the perimeter wall in a direction tending to aid linear movement of the balanced plug.

As discussed above, the balanced valve of Erickson et al. '135 only provides balanced operation when the plug is not in sealing engagement with the valve seat. That is, once the plug 24 comes into sealing engagement with the valve seat, for example as shown in dashed lines in FIG. 5 of Erickson et al. '135, the top end of the plug 24 is no longer exposed to the same fluid pressure as the bottom end of plug 24. This is because the top end of plug 24 is now in sealing contact with the bonnet 14 of the valve. While the pressure from the fluid entering from the right of this FIG. 5 acts on the bottom of the plug 24, this same fluid pressure is unable to act on the plug 24 in a direction to oppose the force applied to the bottom edge of the plug. In other words, the valve of Erickson et al. '135 lacks an end configured to expose a surface to the same fluid pressure that is applied to the other end of

the plug. As a result, the plug of Erickson et al. '135 has a net force applied to the bottom end of plug 24 that tends to impede its linear movement in a downward linear direction. As a result, and as is described by the applicants in the originally filed specification in paragraph [0010] reproduced above, there is a pressure differential across the plug that results in unbalanced forces thereon.

In view of this significant distinction, the applicants respectfully submit that claim 14 is not anticipated by the valve structure of Erickson et al. '135. Reconsideration of this ground of rejection and indication of the allowability of claim 14 and those claims dependent thereon, to wit claims 15-19 are respectfully solicited.

Independent claim 20 requires, *inter alia*, a balanced plug including a first and a second end configured to expose a pressure balancing surface to fluid pressure from the same one of the at least one inlet and the outlet such that the fluid pressure on the perimeter wall in a direction tending to impede linear movement of the balanced plug is balanced by fluid pressure on the perimeter wall in a direction tending to aid linear movement of the balanced plug when one of the first end and the second end is in sealing engagement with the valve seat. As discussed above, the plug of Erickson et al. '135 lacks such a pressure balancing surface that is exposed to the same fluid pressure that is applied to the other end of the plug when the plug is in sealing engagement with the valve seat. As a result, and with reference to FIG. 5 of Erickson et al. '135, a fluid pressure acts in a direction tending to force the plug in an upward direction, while there is no surface that allows that same fluid pressure to act in a downward direction on the sealing end that is sealed and held against the valve seat when the valve is in its closed position (as shown by dashed lines). Therefore, there is a pressure tending to impede the linear downward movement of the plug to allow the valve to be opened that is not balanced by a pressure that would counteract the upward force on the lower end of the plug when the plug is in sealing engagement with the valve seat. As such, the applicants respectfully submit that the plug of Erickson et al. '135 does not anticipate the plug of independent claim 20. Reconsideration of this ground of rejection and indication of the allowability of claim 20 at an early date are respectfully solicited.

If the Examiner believes that a telephonic conversation will aid in the resolution of any issues not resolved herein, the Examiner is invited to contact the applicants attorney at the telephone number listed below.

Respectfully submitted,

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